

Course Title:	Mathematics & the Trades (A)
Grade(s):	11-12

Course Description
This course focuses on the algebraic and geometric skills required in a number of vocational and technical trades, such as plumbing, carpentry, automotive repair, electrical trades, construction, landscaping, HVAC, and culinary arts. It is a course intended for students who can benefit from additional practice and review of skills covered in Algebra and Geometry, and is highly recommended for students focused on pursuing a career in the vocational/technical trades. The course will reinforce many of the concepts covered in Algebra 1 and Geometry by providing more authentic applications in a number of career fields. Examples provided in class and in assignments will try to focus on student preferences, and hands-on activities will be used where possible and appropriate. Course Units: 1. Reading a Ruler & Working with Fractions and Decimals 2. Ratios, Proportions and Percents 3. The Art of Measurement - Getting it Right 4. Algebraic Concepts 5. Plane Geometry 6. Solid Geometry 7. Right Triangles and Trigonometry 8. Statistics
Approved Curricular Materials/Textbook(s)

Unit Title	Unit Description (Include Unit Objectives)	Unit Pacing
Unit 1: READING A RULER FRACTIONS DECIMALS	In the professional world, being "close enough" usually isn't good enough—a fraction of an inch can be the difference between a door that swings perfectly and one that won't close at all. This unit is designed to give you total control over the tools of your trade. You will master how to read rulers and measuring tapes in both U.S. and Metric units, ensuring you can work on any job site anywhere. By the end of this unit, you'll be able to move between fractions and decimals quickly and accurately, giving you the math "fluency" needed to solve real-world problems with or without a calculator. The unit will be broken into two parts. The first part of the unit focuses on the ability to read a ruler and other basic measuring instruments using both Metric Units and Imperial or US Measurements. This part of the unit also focuses on fractions and the basic arithmetic skills that are important in all occupational trades (adding, subtracting, multiplying and dividing). Students will strengthen their ability to work with fractions. These basic skills will be reviewed and assessed using problems focused on real applications, and students will be expected to have a level of fluency with these calculations, with and without the use of a calculator. Students will need to read and understand a variety of vocational/technical problems and solve these problems using their mathematical skills. The second part of the unit will focus on decimals and will include a review of proper rounding techniques. Students will also review how to switch between fraction measurements and decimal measurements. Unit Topics Include: Part 1: Mastering Fractions and the Tape Measure • The Pro's Ruler: Learn to read every mark on a tape measure or ruler so you never have to guess a measurement again. • Blueprint Math: Master adding and subtracting fractions to calculate the total length of a wall or the amount of wood needed for a frame.	5 weeks (August - September)

	• Scaling Up: Use multiplication and division to adjust recipe sizes in Culinary Arts or determine the spacing for fence posts in Landscaping. • Imperial vs. Metric: Understand how to work with inches and feet, as well as millimeters and centimeters, used in Manufacturing and Automotive trades. • Dice Project: Learning about some power tools, and students setting up/designing their dice. Part 2: Decimals, Rounding, and Conversions • The Switch: Learn the "pro trick" for turning fraction measurements (like $\frac{3}{8}$") into decimals for high-precision work in Machine Tech. • Dead-On Accuracy: Practice proper rounding so your final numbers are accurate enough for Electrical wiring or Interior Design layouts. • Real-World Conversions: See how decimals are used to calculate the square footage of a room for Flooring or the exact amount of material needed for Masonry and bricklaying.	
Unit 2: RATIOS, PROPORTIONS & PERCENTS	This unit reviews the concepts of ratios, proportions and percents, with a focus on how they are used in the vocational/technical trades. Math isn't just about numbers on a page; it is a tool you will use every day on the job site. In this unit, we will look at how ratios and percentages help you build, fix, and create. Whether you are calculating the "pitch" of a roof, adjusting the gears on a machine, or figuring out the final cost of supplies, you are using ratios and percentages. We will show you how to handle these numbers so you can build, fix, and create with total confidence. We will move past the textbook and focus on the exact math skills you need to be successful in the trades, showing you how to get the right measurements every single time.	5 weeks (October - November)

	Unit Topics Include • The Right Mix: Learn how to use ratios for engine compression, mixing mortar for masonry, or treating a water supply with the right amount of chlorine. • Reading the Plan: Use scale drawings and blueprints to figure out the real-life size of a room or a piece of machinery. • Money and Materials: Master percentages to calculate sales tax on expensive equipment and find the best discounts when buying bulk supplies for a job. • Power and Parts: Understand how ratios work in the real world, from electrical voltage in transformers to the way gears turn in a factory. • Trade-Specific Skills: See how this math is used in your future career, including: - Construction & Carpentry: Calculating roof slopes and measuring lumber. - Mechanical & Technical: Working with HVAC, welding, and automotive engines. - Service & Design: Mastering culinary recipes, plumbing layouts, and landscaping costs.	
Unit 3: THE ART OF MEASUREMENT: Getting it Right	In the world of trades and technology, "close enough" can lead to expensive mistakes, wasted materials, or even dangerous accidents. Precision is the heartbeat of the skilled trades. In a world where a fraction of a millimeter can be the difference between a high-performance engine and a seized motor, or a leak-free pipe and a flooded basement, understanding the mechanics of measurement is non-negotiable. This unit moves beyond "close enough" to the rigorous standards of accuracy and precision required to maintain professional certifications and safety standards. This unit is all about the power of measurement. You will learn how to use both U.S. Customary units (inches, feet, pounds) and Metric units (millimeters, grams) like a pro. We will also dive into the "Big Three" of professional work: Accuracy (hitting your mark), Precision (being consistent), and Tolerance (knowing exactly how much wiggle room you have). By mastering these skills, you'll ensure that every cut you make and every part you	3 weeks (November - December)

install fits perfectly every time.

Unit Topics & Vocational Applications:

- Metric and Imperial Switching Systems (Unit Conversions)
 - Automotive Technology: Converting torque specifications from foot-pounds (lb ft) to Newton-meters (N m) when working on international vehicle models.
 - Manufacturing: Translating blueprint dimensions from inches to millimeters to program CNC machinery for global export parts.
 - Medical/Pharmacy Tech: Converting liquid volumes between milliliters and ounces to ensure exact dosage for patient safety.
- Accuracy vs. Precision in Practice
 - Welding: Maintaining precision by consistently laying beads of the same width and depth across a long structural seam.
 - Machining: Calibrating a lathe to ensure accuracy, hitting the exact specified diameter of a shaft on the very first pass.
- Tolerance and "Wiggle Room" Calculations
 - Electrical Trades: Calculating the allowable voltage drop tolerance in a circuit to ensure sensitive electronics don't malfunction.
 - Plumbing: Working within tight tolerances when fitting pressurized gas lines to prevent microscopic leaks at the joints.
 - Aviation Maintenance: Checking the "wear limits" or tolerances of turbine blades, where even a hair's width of deviation requires a part replacement.
- Significant Digits and Rounding Logic
 - Carpentry: Understanding which decimals matter when measuring a stair stringer so that a tiny rounding error doesn't accumulate into a dangerous trip hazard at the top step.
 - Landscaping: Determining the significant digits needed when ordering bulk gravel or mulch for a multi-acre project to avoid a massive budgetary shortfall.
- Material Estimation and Waste Reduction
 - Masonry & Flooring: Calculating the exact number of tiles or bricks needed for a specific area ($A = L \times W$), then adding a precise "waste

	factor" percentage (5%-10%) to account for cuts. - Culinary Arts: Scaling up a recipe for large-scale catering by converting household measurements (teaspoons) into commercial weights (grams) to maintain flavor consistency. • Phone Amplifier Project: Students making precise measurements.	
Unit 4: ALGEBRAIC CONCEPTS	This unit will review some basic algebraic concepts with a focus on their applications in the vocational/technical trades. Algebra is simply the art of finding a "missing piece" of a puzzle. In the trades, you won't always have every measurement or number handed to you on a silver platter. You might know how much space you have and what the final result needs to look like, but you have to calculate the steps to get there. Whether you are balancing a load on a circuit, figuring out the "run" of a stairway, or calculating how much pressure a pipe can hold, you are using algebraic formulas. This unit will teach you how to use these "math shortcuts" to solve complex problems quickly and accurately. Unit Topics & Vocational Applications: • Solving Linear Equations (Finding "X") - Landscaping & Masonry: Calculating the exact spacing for fence posts or decorative bricks to ensure they are perfectly even across a fixed total distance. - Automotive Tech: Determining the required amount of coolant concentrate to add to a system to reach a specific freezing point percentage. • Formula Rearrangement and Literal Equations - Electrical Trades: Using Ohm's Law ($V = IR$) to solve for voltage, current, or resistance to ensure circuits are safely fused and balanced. - Plumbing & HVAC: Manipulating pressure and flow formulas to determine the necessary pipe diameter needed to maintain consistent water pressure across multiple floors.	5 weeks (December - January)

	• Geometric Algebra (The Pythagorean Theorem) - Carpentry & Framing: Utilizing the $a^2 + b^2 = c^2$ relationship to verify that wall plates and floor joists are perfectly "square" (90°) during the rough-in phase. - Telecommunications: Calculating the length of a support "guy wire" needed for a utility pole based on the height of the pole and the distance of the anchor from the base. • Systems of Equations and Break-Even Analysis - Agri-business: Calculating the "break-even" point by balancing variable costs (seed, fertilizer) against fluctuating market prices to determine minimum crop yield. - Culinary Arts: Using variables to find the "price per plate" for catering contracts, ensuring that food costs and overhead are covered while maintaining a profit margin. • Ratio and Proportion Applications - Construction/Masonry: Using proportions to mix concrete or mortar to a specific strength ratio (e.g., 1 part cement to 2 parts sand). - Manufacturing: Calculating gear ratios to determine the final output speed (RPM) of a motorized assembly line. • Mason Jar Dispenser Project	
Unit 5: PLANE GEOMETRY	This unit will focus on the applications of plane geometry: intersecting lines, angle measures, arc-length, perimeter and area. Geometric principles are the invisible blueprints of the physical world. Whether you are calculating the precise angle for a miter cut in cabinetry or determining the square footage of roofing material needed for a complex pitch, a firm grasp of plane geometry is essential for precision, efficiency, and waste reduction. By mastering the relationships between lines, angles, and shapes, vocational professionals can translate two-dimensional plans into sturdy, accurate three-dimensional structures. Unit Topics & Vocational Applications: • Intersecting Lines and Transversals - Framing Carpentry: Ensuring wall studs are perfectly parallel and	4 weeks (January - February)

	understanding the angles created when a diagonal brace intersects a frame. - Electrical Wiring: Mapping out conduit paths that cross at specific angles to maintain code clearances. • Angle Measures and Geometric Construction - Cabinet Making: Using protractors and miter saws to create precise 45° or 22.5° joints for custom trim and molding. - Plumbing: Calculating the "offset" needed for pipes to bypass obstacles using specific elbow angles like 45 or 90 degree bends. • Arc Length and Curvature - Sheet Metal Fabrication: Determining the flat length of metal required to create a rounded duct or a curved flashing component. - Landscaping: Measuring the stone edging needed for circular fire pits or winding garden paths. • Perimeter and Linear Boundaries - Siding and Fencing: Calculating the total linear footage of starter strips for a house or the amount of chain-link mesh required to enclose a lot. - Masonry: Estimating the number of bricks needed for the perimeter of a patio foundation. • Area and Surface Coverage - Roofing: Using area formulas adjusted for pitch to determine how many "squares" of shingles to order. - Flooring and Carpeting: Calculating the total square yardage of a room, including subtracting for "cutouts" like hearths or closets to minimize material waste.	
Unit 6: SOLID GEOMETRY	While plane geometry deals with the "flat" world of blueprints and floor plans, Solid Geometry is where those designs take up space and gain weight. In the vocational world, moving from two dimensions to three is the difference between drawing a pipe and knowing how much water it holds, or sketching a roof and knowing how many bundles of shingles are required to cover it. Mastering the properties of 3D solids—from the simple cube to the complex frustum—allows technicians to calculate material costs, shipping weights, and structural capacities	3 weeks (February - March)

with absolute precision.

Unit Topics & Vocational Applications:

- Identification of Solid Figures (Prisms, Pyramids, Spheres, & Frustums)
 - HVAC Technician: Identifying rectangular and cylindrical ductwork to determine airflow patterns.
 - Manufacturing: Recognizing a frustum (a cone or pyramid with the top cut off) when creating transitions for industrial hoppers or funnel systems.
- Differentiating Surface, Lateral, and Volume Measures
 - Painting/Coating: Calculating lateral area (the sides only) to estimate how much paint is needed for a room's walls without including the floor or ceiling.
 - Logistics/Warehousing: Understanding volume to determine how much "cube space" a shipment will occupy in a shipping container.
- Surface Area of Common Solids
 - Sheet Metal Worker: Calculating the total surface area of a transition piece to determine the exact amount of flat galvanized steel needed before folding.
 - Concrete Masonry: Finding the surface area of a decorative sphere or bollard to apply a specific weather-sealing finish.
- Volume of Common Solids
 - Plumbing: Using the volume formula for a cylinder to find the capacity of a hot water tank or the amount of fluid in a run of pipe.
 - Construction/Excavation: Calculating the volume of a pyramid-shaped pile of gravel or soil to determine how many dump truck loads are required for removal.
- Surface Area and Volume of Composite Figures
 - Carpentry: Calculating the volume of a "bump-out" window or an L-shaped room by breaking the complex shape into smaller, manageable prisms.
 - Automotive Tech: Determining the total displacement of an engine cylinder head (a complex composite shape) to calculate compression ratios.

	● Practical Vocational Applications - Landscaping: Determining the volume of mulch needed for a circular tiered garden bed (a series of stacked cylinders). - Roofing: Calculating the surface area of a "hip roof" which consists of multiple triangles and trapezoids to ensure zero material waste.	
Unit 7: RIGHT TRIANGLES & TRIGONOMETRY	In this unit, we move from basic shapes to the specific power of the triangle—the most stable and versatile figure in construction and design. You will learn to move beyond simple measurements to calculate "unreachable" distances and complex angles using the Three Ratios (Sine, Cosine, and Tangent) and advanced laws for non-right triangles. For a technical professional, these aren't just buttons on a calculator; they are the tools used to ensure a roof doesn't collapse under snow loads, a surveyor's boundary is accurate to the inch, and a machinist's part fits perfectly within a high-tolerance engine. Unit Topics & Vocational Applications ● Right Triangle Trigonometry (SOH CAH TOA) - Roofing & Framing: Using the Tangent ratio to determine the precise "pitch" or slope of a roof based on the rise and run of the rafters. - Electrical Technology: Calculating the "impedance triangle" where resistance and reactance form the legs of a right triangle, and the hypotenuse represents the total impedance. ● The Sine Ratio (sin) and Cosine Ratio (cos) - HVAC & Sheet Metal: Determining the length of a diagonal transition duct when given the angle of the offset and the width of the plenum. - Telecommunications: Calculating the height of a cell tower using the length of a guy wire and the angle it makes with the ground. ● Law of Sines - Land Surveying: Determining the distance between two points separated by an obstacle (like a lake or building) by measuring angles from a third, accessible point.	4 weeks (March - April)

	- Aviation/Navigation: Calculating a "drift angle" to correct for wind speed and direction to ensure a pilot stays on the intended flight path. • Law of Cosines - Cabinetry & Fine Woodworking: Finding the exact angle for a corner cabinet in a kitchen where the walls are "out of square" (not exactly 90 degrees). - Mechanical Engineering: Calculating the distance between two moving parts on a mechanical linkage when the angle between them changes. • Structural Properties of Triangles - Civil Engineering: Understanding why triangles are used in bridge trusses to distribute weight; using trigonometry to calculate the tension and compression on specific beams. - Landscaping: Laying out "true" corners for large decks or retaining walls using the Pythagorean theorem as a foundational check.	
Unit 8: STATISTICS	In the modern workplace, data is the language of efficiency and quality control. Whether you are tracking the failure rate of a specific mechanical part, monitoring the fluctuating costs of raw lumber, or analyzing the flow of traffic through a network, the ability to translate raw numbers into visual stories is essential. This unit focuses on how to organize, represent, and interpret data so that vocational professionals can make informed, evidence-based decisions that save time, money, and resources. Unit Topics & Vocational Applications • Frequency Distributions and Data Organization - Automotive Technician: Tracking the frequency of specific diagnostic trouble codes (DTCs) across a fleet of vehicles to identify a common manufacturing defect. - Inventory Management: Organizing stock levels into categories to determine which high-turnover items need more frequent reordering. • Bar Graphs and Histograms	4 weeks (April - May)

	- HVAC Specialist: Creating a histogram to show the distribution of indoor temperatures in a large building to identify "cold spots" where airflow is restricted. - Construction Foreman: Using a bar graph to compare the estimated labor hours versus actual hours spent on different phases of a project (e.g., foundation, framing, electrical). • Line Graphs and Trend Analysis - Electrical Lineman: Monitoring a line graph of peak power usage during different times of the day to prevent transformer overloads. - Manufacturing: Using "Run Charts" to track the precision of a CNC machine over an eight-hour shift to ensure parts remain within tolerance. • Circle Graphs (Pie Charts) - Landscaping Business Owner: Visualizing a budget breakdown to see what percentage of total costs is being spent on labor, fuel, materials, and equipment maintenance. - Culinary Arts: Representing the nutritional breakdown (macronutrients) of a signature dish for menu labeling. • Measures of Central Tendency (Mean, Median, Mode) - Quality Control Inspector: Calculating the mean (average) thickness of a batch of glass panels to ensure they meet safety standards. - Real Estate/Appraisal: Finding the median home price in a specific neighborhood to provide an accurate valuation that isn't skewed by one extremely expensive mansion. - Retail/Parts Manager: Identifying the mode (the most frequently sold tire size) to ensure the shop always has the most popular items in stock. • Measures of Dispersion (Range and Standard Deviation) - Machinist: Calculating the range of measurements on a set of pistons to determine if the manufacturing process is consistent or needs recalibration. - Medical Lab Technician: Using standard deviation to determine if a patient's test results fall within a "normal" healthy range or indicate a medical outlier.	
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FINAL PROJECT	Adirondack Chairs	(May - June)
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